

THE WEATHER AND CIRCULATION OF DECEMBER 1950¹

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The weather and circulation of December 1950 are notable for the degree of persistence which operated from the preceding month. The monthly temperature and precipitation anomalies in the United States for the two periods are remarkably similar. The mean temperatures in the West persisted above the seasonal normals, while in the East, with the exception of New England, the weather was colder than normal. Precipitation continued abundant in New England, the Great Lakes region, and the Northwest, while drought conditions prevailed over the Southern Plains and the Southwest.

A great deal of similarity is also apparent in several features of the 700-mb. circulations for the 2 months (fig. 1). A low center was present in the Gulf of Alaska with a trough and below normal heights extending southward to the vicinity of the Hawaiian Islands. A ridge with heights above normal was located over western North America. A full latitude trough extending from northern Canada to Florida maintained its greatest intensity in the United States and was weaker than normal in Canada. The ridge in the western North Atlantic,

¹ See charts I-XI following p. 225, for analyzed climatological data for the month.

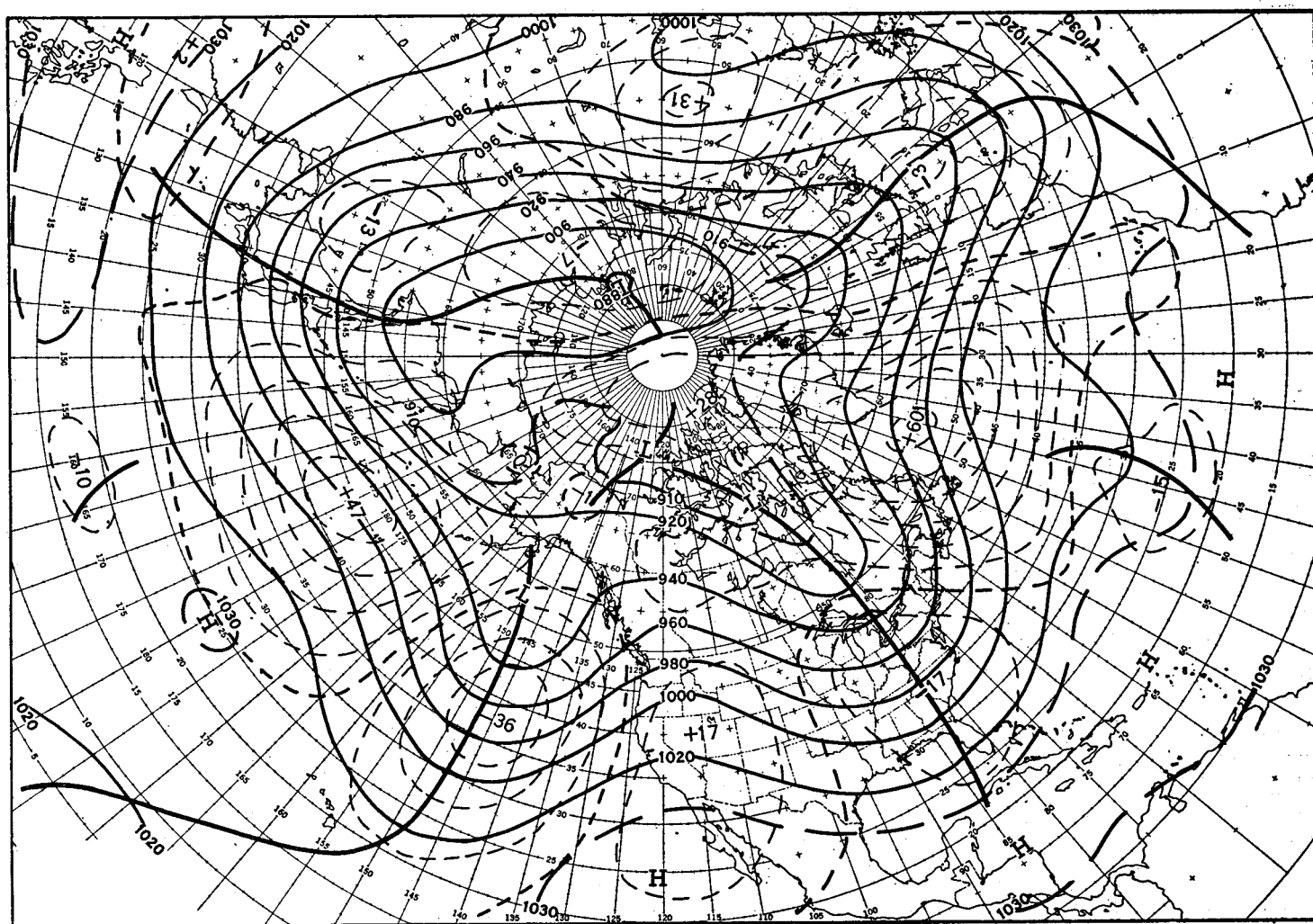


FIGURE 1.—Mean 700-mb. chart for the 30-day period November 28–December 27, 1950. Contours at 200-ft. intervals are shown by solid lines, 700-mb. height departures from normal at 100-ft. intervals by dashed lines with the zero isopleth heavier. Anomaly centers and contours are labeled in tens of feet. Minimum latitude trough locations are shown by heavy solid lines.

however, had more pronounced blocking characteristics in December when a well defined split in the 700-mb. jet stream was apparent (fig. 2). Other features of the jet stream are similar to those of the preceding month with the exception of the greater amplitude to the meanders over the United States. It also appears significant that the center of maximum wind speed which was located upstream from the weakly reverse-tilted (NNW-SSE) trough in the eastern United States during November was found slightly to the east of the north-south oriented trough in December.

The anticyclone tracks over North America (Chart II) continued from northwestern Canada through the Northern Plains to the Southeast. In northwest Canada, where these anticyclones originated, a mean sea level High was located with central pressure six millibars above normal. The elongation of this sea level anticyclone southeastward into the Northern Plains (not shown) very clearly defines the main anticyclone track. The anticyclonic vorticity associated with the secondary jet stream in northern Canada (fig. 2) is also indicative of this track. It is interesting that several of these anticyclonic vortices dissipated north of the mean jet stream in the eastern United States where the vorticity of the mean 700-mb. current was strongly cyclonic.

At first glance, the cyclone tracks for December (Chart III) appear completely confused. This is mainly due to the effect of the ridge in the western Atlantic which had blocking characteristics during the first half of the month. Most of the cyclones in eastern North America traveled toward the north-northwest while this blocking ridge was active. In the latter part of the month cyclones took the more normal path across the North Atlantic south of Greenland. Over the United States, the main cyclone path followed the mean flow aloft and was located in the zone of cyclonic shear immediately to the north of the jet stream (fig. 2). Many new cyclones formed during the month in the region of cyclogenesis located over the eastern United States and adjacent ocean. This was mainly to the east of the 700-mb. trough and near the center of maximum speed along the jet stream (figs. 1 and 2). Another region of cyclone formation (Chart III) was located in the eastern Pacific, in the vicinity of the deep trough and isotach maximum at 700 mb. (figs. 1 and 2).

Let us turn our attention now to the surface temperature anomaly and its relation to the mean circulation. Chart I shows the great contrast in the temperature anomalies observed in different regions of the United States.

The warm weather in the West established new monthly mean temperature records at several stations, among these being San Francisco, Ely, Yuma, and Albuquerque. The mean 700-mb. circulation (fig. 1) shows that the air entering the West had a more southerly trajectory than normal. This can be seen from the meridional flow indicated by the height anomaly of the 700-mb. surface.

The above-normal heights in the West are also related to the warm temperatures. In the Great Basin, where a sea level anticyclone was observed (Chart VI), the unusual lack of snowcover (inset Chart VII) contributed to the warm weather. In December, a Great Basin High is frequently associated with cool mean temperatures, but the lack of snowcover in this case allowed less radiative cooling than normal. The persistence of valley fogs in Utah and Nevada for approximately two-thirds of the month was reflected in the low percentage of clear sky observed (Chart IV), and also reduced the radiative cooling of the surface.

Below normal temperatures were observed from the Great Lakes to Florida and several new daily records were set. The 700-mb. heights were below normal over this region and the flow aloft was northerly relative to normal. Several cold waves accompanied the polar continental anticyclones which entered this region from the northwest. The unusually intense polar air which was generated in Canada and the anticyclone tracks (previously discussed) were instrumental in causing this cold weather.

In New England, unseasonably warm temperatures established a new mean temperature record at Caribou. The mean flow relative to normal both at sea level and aloft was from the southeast. As a result, the relatively warm water offshore had a greater moderating effect than usual and tempered the weather in this area. Since the strongly developed blocking ridge east of Newfoundland (fig. 1) was associated with the mean southeasterly flow relative-to-normal, it is especially apparent that the warm temperatures observed in New England were related to large scale features of the circulation.

Consider now the relationship between the observed monthly precipitation and the average circulation. In the Northwest, precipitation continued to be abundant (inset Chart V). The deep trough in the eastern Pacific and the strong southerly flow relative to normal caused considerable amounts of moisture to be transported

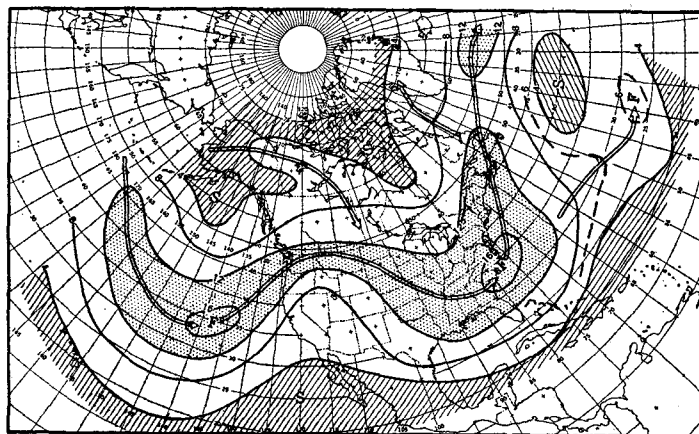


FIGURE 2.—Mean geostrophic (total horizontal) wind speed at 700-mb. for the 30-day period November 28–December 27, 1950. Isobars at 4-m. p. s. intervals are shown by solid lines while the axes of maximum wind speeds (jets) are shown by double lines.

northward into the westerlies along the West Coast. In addition, orographic lifting, which is related to the strength of the westerlies in this area, was slightly greater than normal. The precipitation in this area would have been heavier except for the mean anticyclonic vorticity and the positive anomaly of 700-mb. heights both of which restricted the cyclonic activity (Chart III).

A deficiency of precipitation persisted from November in the middle and southern Great Plains and the Southwest. Drought conditions in the southern Great Plains caused poor growth of winter wheat and pastures deteriorated over most of the region. A new monthly record for deficient precipitation was set at Fort Worth while the records were tied at El Paso and Presidio, Tex., and Albuquerque, N. Mex. The flow aloft was from the northwest and northerly relative to normal. This decreased the usual supply of moisture from the Gulf of Mexico. The air entering this region was mainly of Pacific origin and extensive foehn drying took place. The cyclonic

activity in this area was greatly restricted (Chart III) due to the mean anticyclonic vorticity associated with the jet stream to the north and the strong ridge in the west.

In the vicinity of the Great Lakes and the Northeast, copious amounts of precipitation were recorded for this month mainly in the form of snow (see Chart VII). Minneapolis reported fifteen consecutive days of snow and Duluth had the excessive amount of 25 inches in a 24-hour period. The excessive precipitation in the region surrounding Duluth was related to the easterly flow relative to normal at sea level and aloft accompanied by the warming and moisture source of the Great Lakes. A deep mean trough aloft was centered in Ohio and the associated mean cyclonic vorticity extended both to the west and east.

Normal amounts of precipitation were recorded in the Southeast. The location and intensity of the mean trough were favorable for precipitation in this region. Greater precipitation would have been expected if the trough had a northeast-southwest tilt.

Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, December 1950

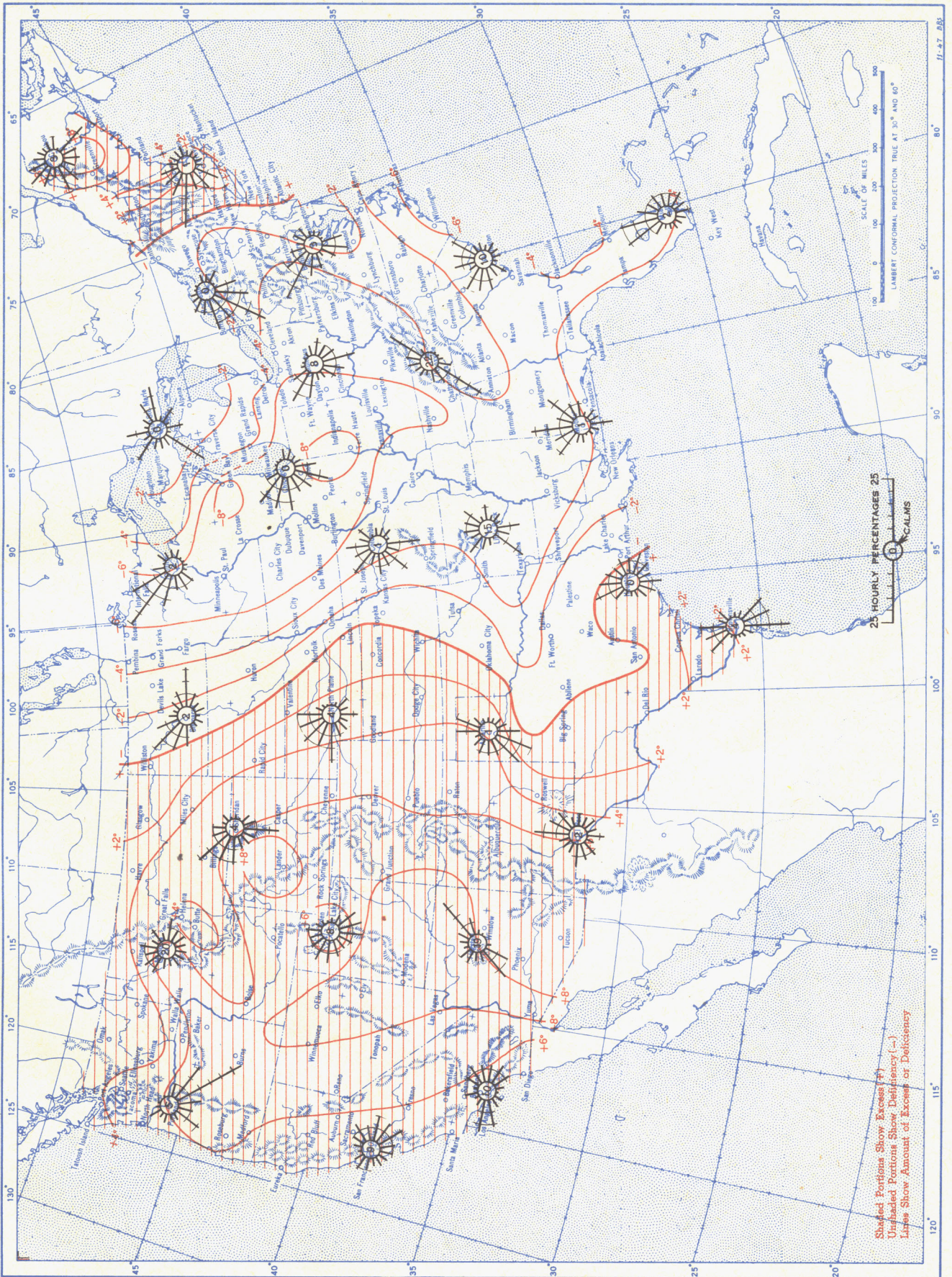
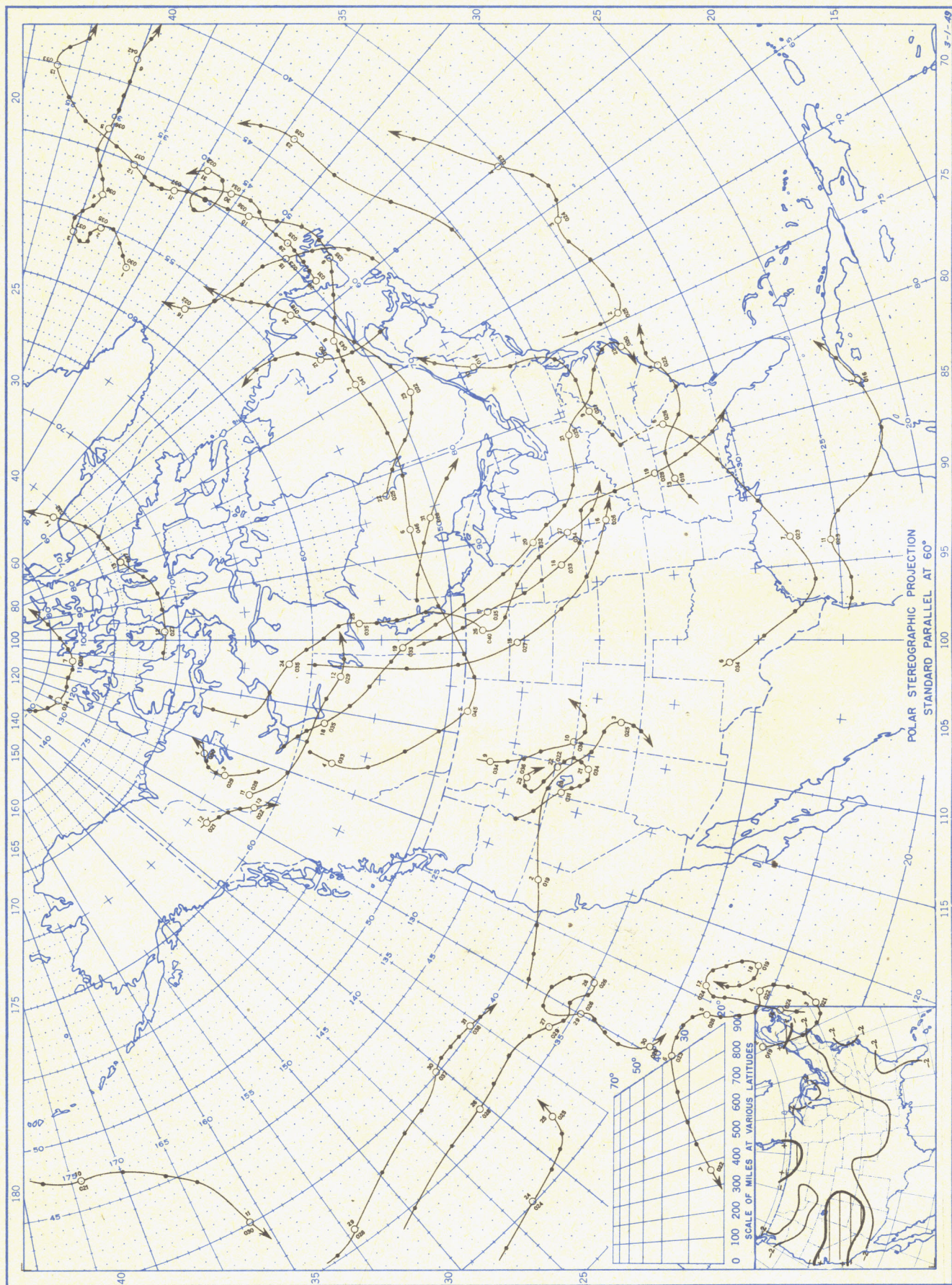
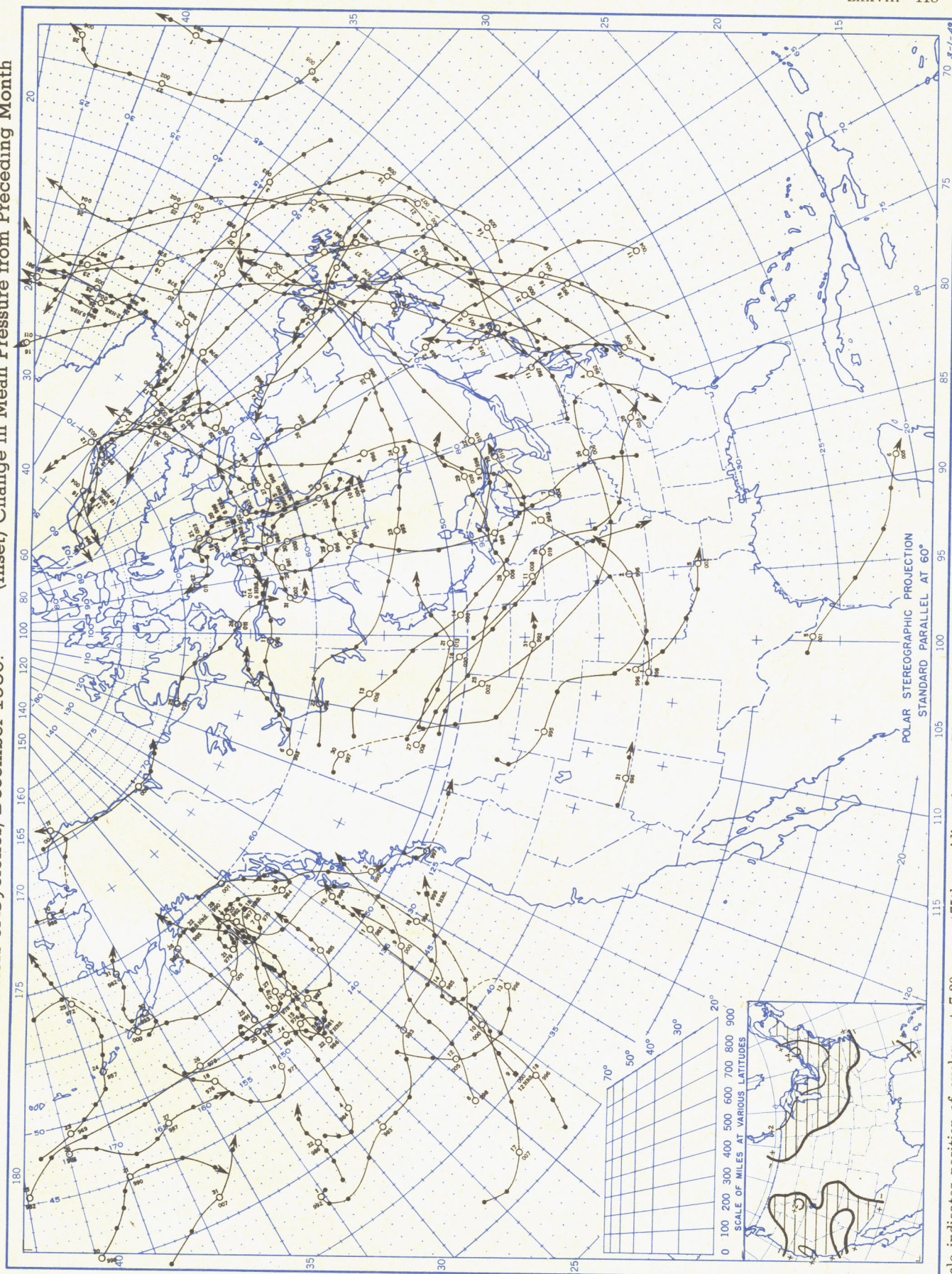


Chart II. Tracks of Centers of Anticyclones, December 1950. (Inset) Departure of Monthly Mean Pressure from Normal



Circle indicates position of anticyclone at 7:30 a. m. (75th meridian time). Figure above circle indicates date, and figure below, pressure to nearest millibar. Dots indicate intervening 6-hourly positions. Square indicates position of stationary center for period shown. Only those centers which could be identified for 24 hours or more are included.

Chart III. Tracks of Centers of Cyclones, December 1950.



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time). Figure above circle indicates date, and figure below, pressure to nearest millibar. Dots indicate intervening 6-hourly positions. Square indicates position of stationary center for period shown. Only those centers which could be identified for 24 hours or more are included.

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, December 1950

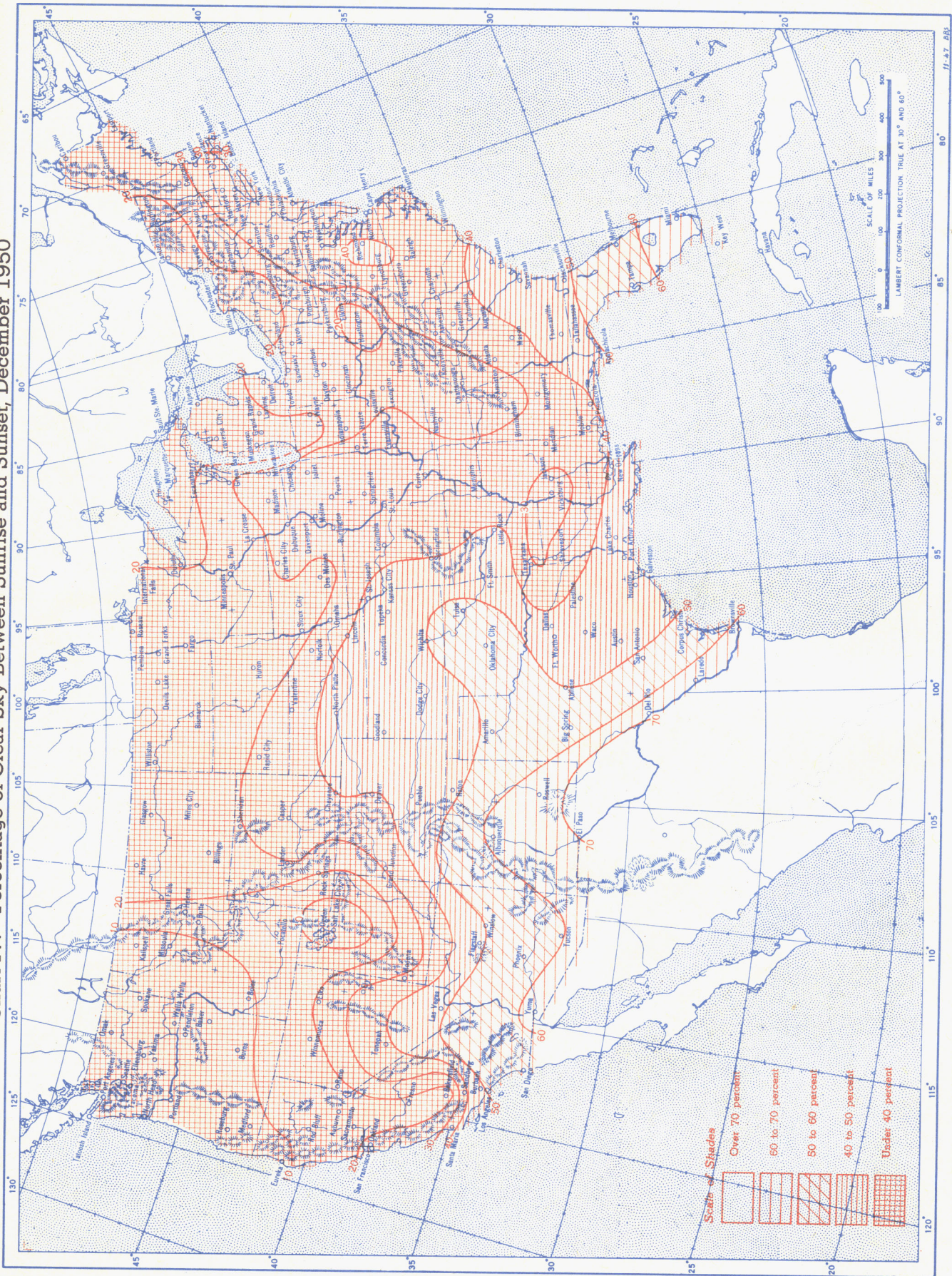


Chart V. Total Precipitation, Inches, December 1950.

(Inset) Departure of Precipitation from Normal

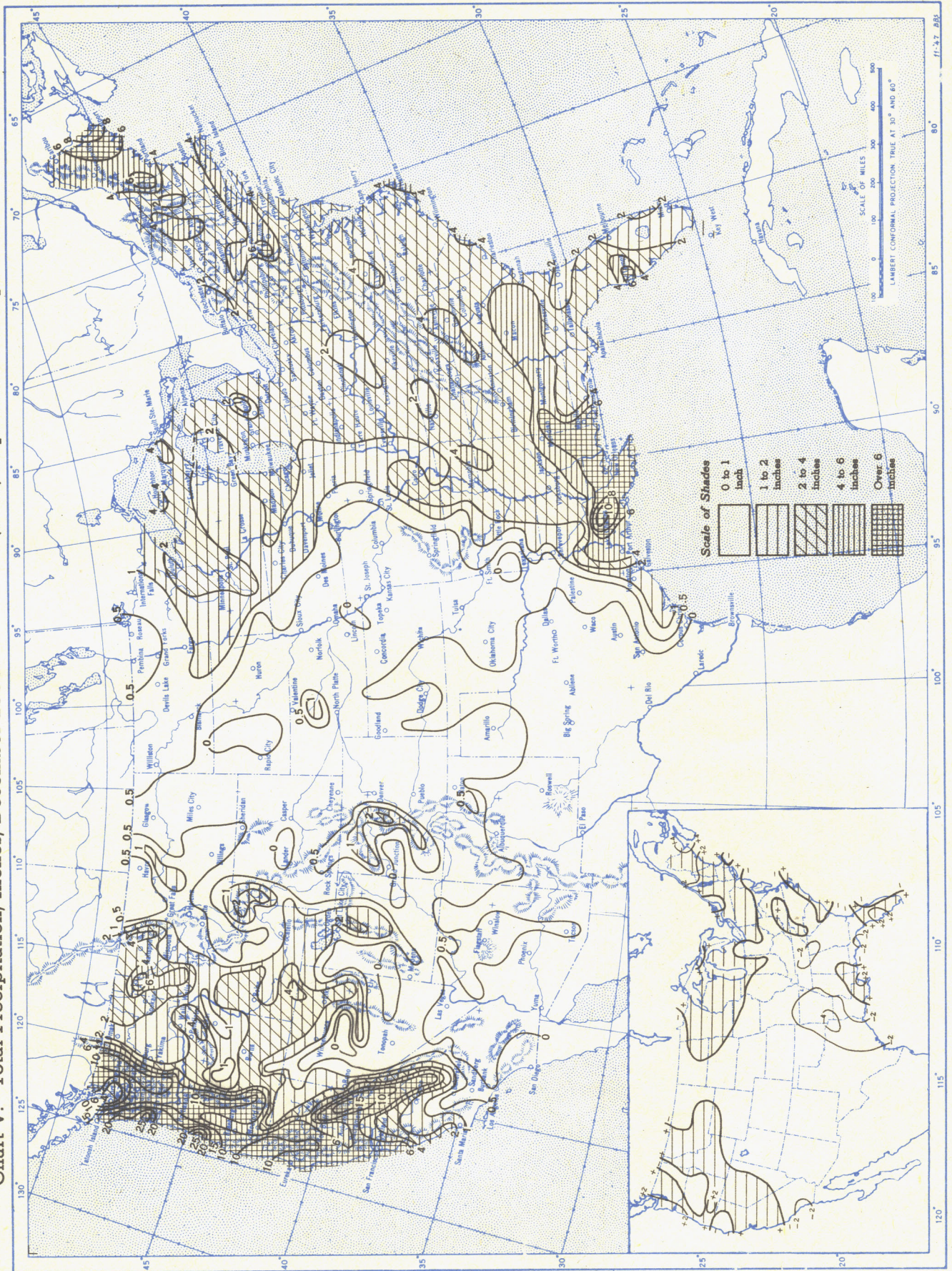


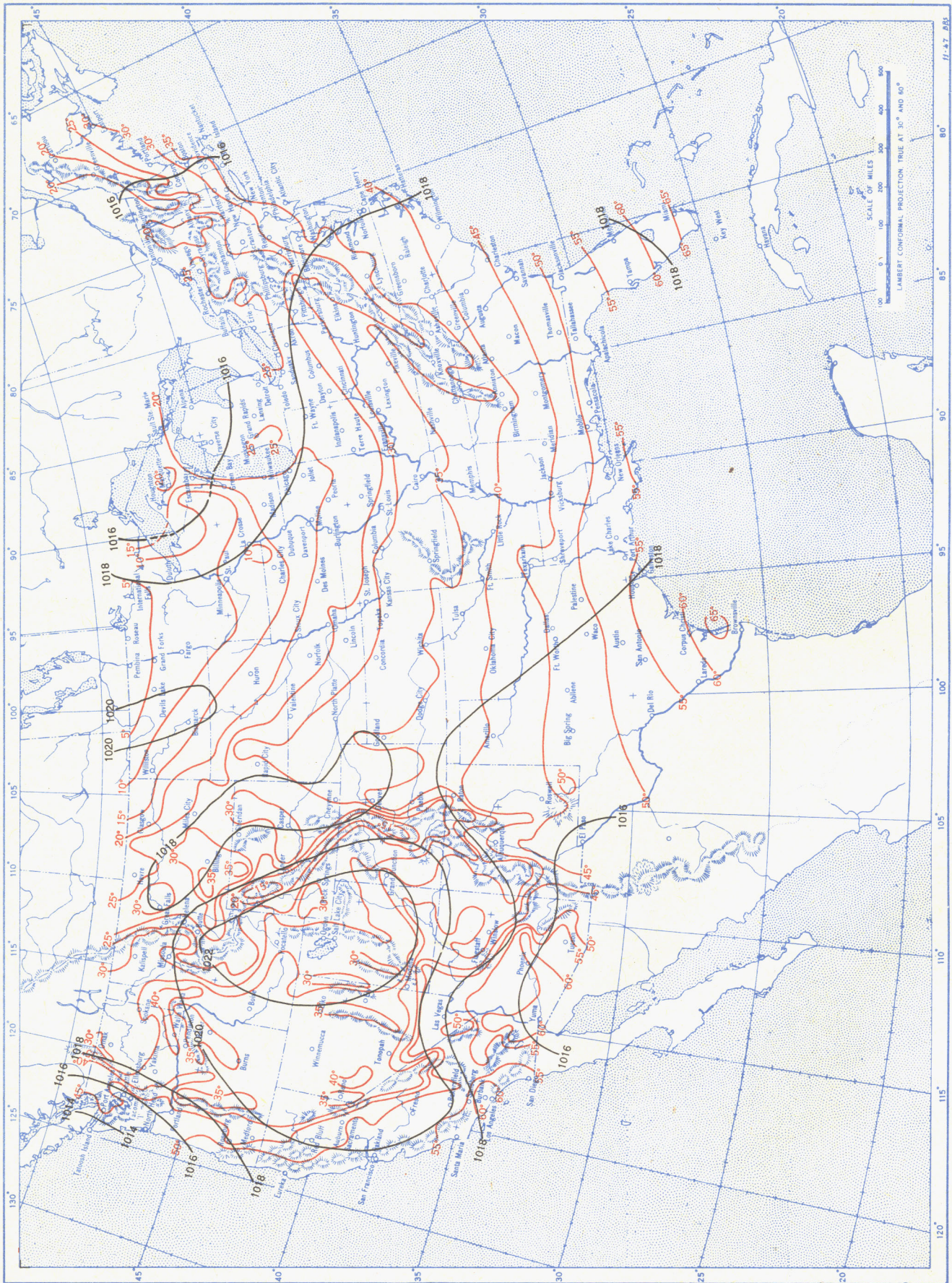
Chart VI. Mean Isobars (mb.) at Sea Level and Mean Isotherms ($^{\circ}\text{F}$) at Surface, December 1950

Chart VII. Total Snowfall, Inches, December 1950. (Inset) Depth of Snow on the Ground at 7:30 a. m., December 26, 1950

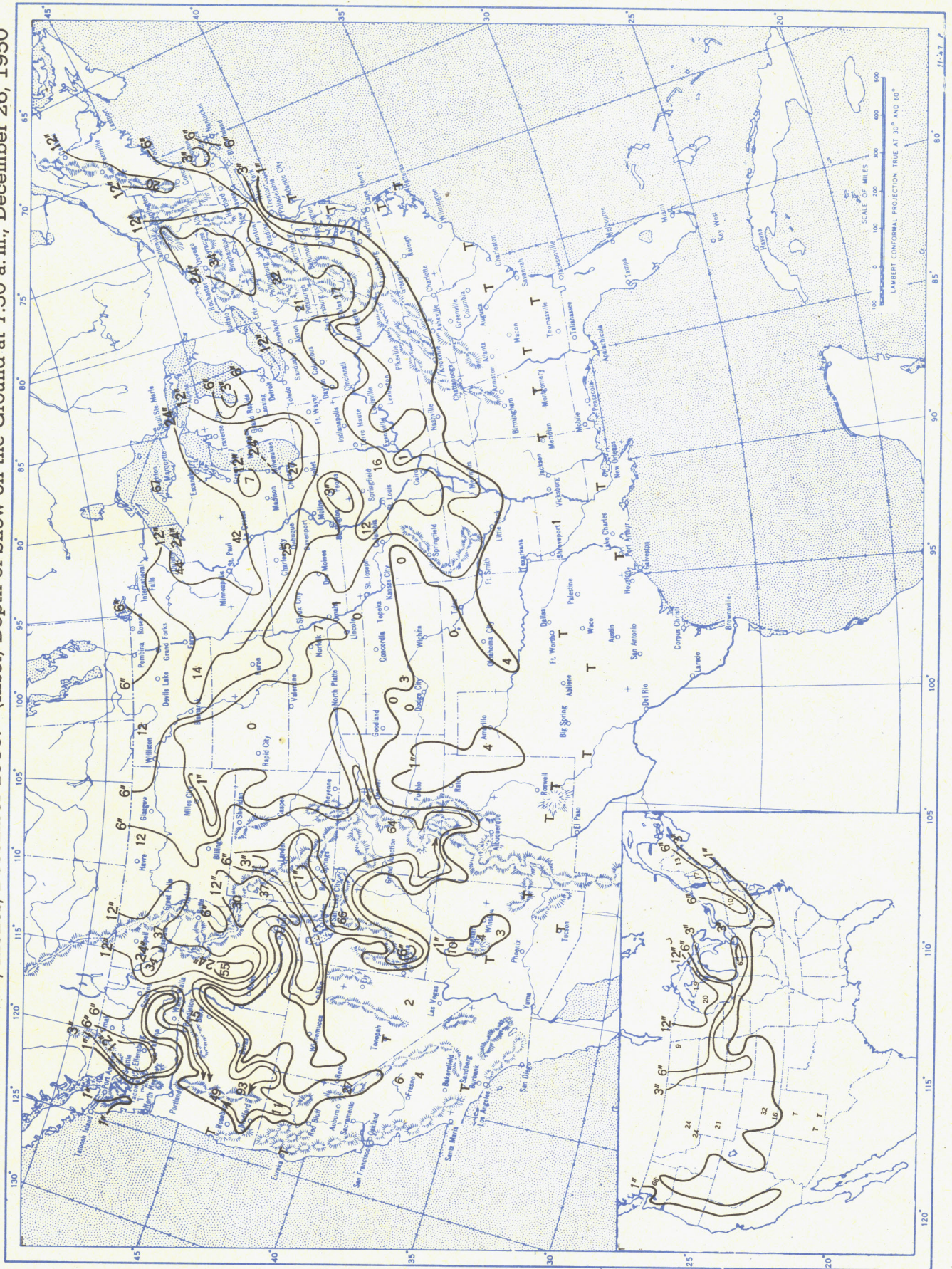
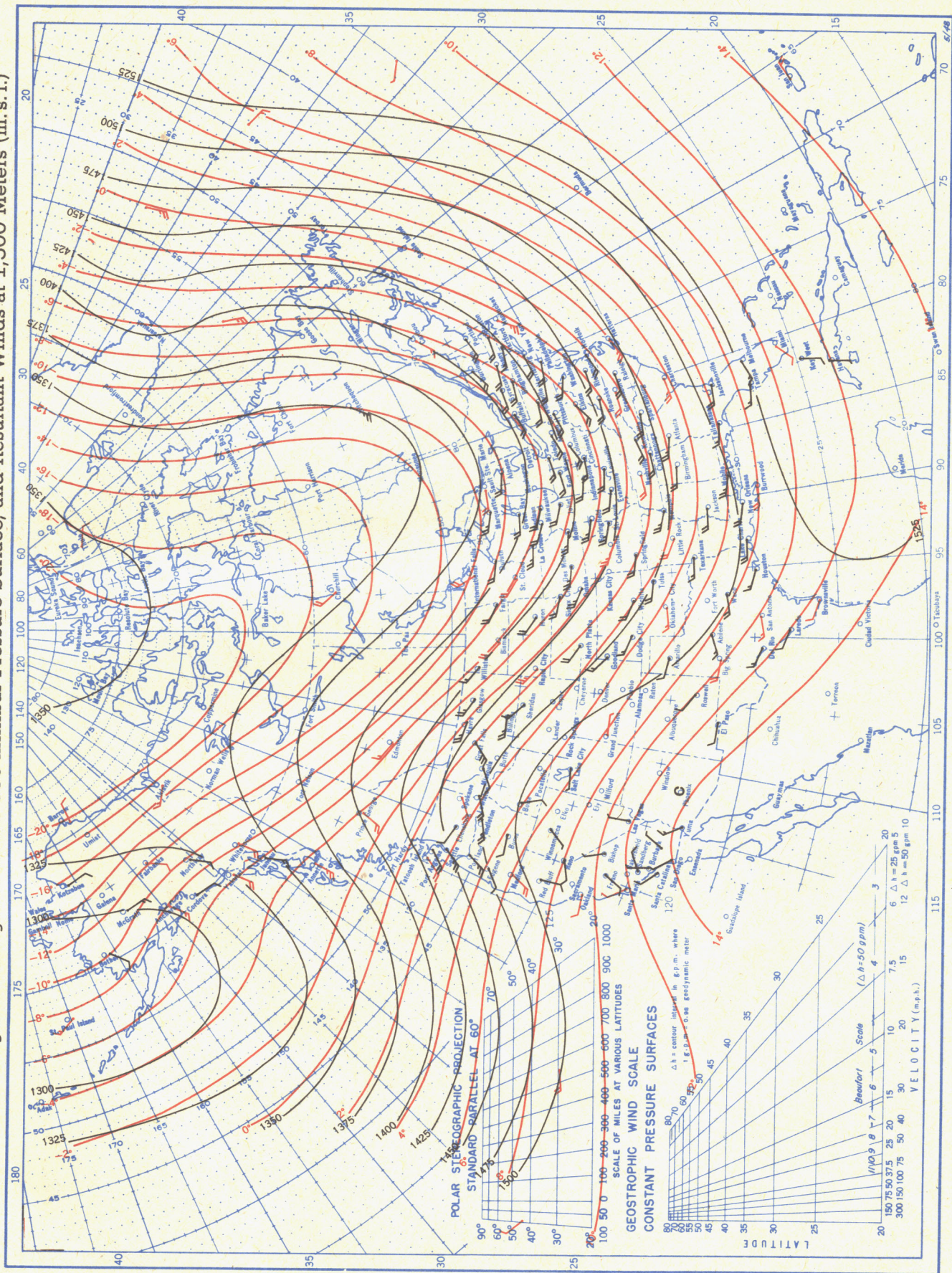


Chart VIII, December 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 850-millibar Pressure Surface, and Resultant Winds at 1,500 Meters (m. s.l.)



Contour lines and isotherms based on radiosonde observations at 0300 G. C. T. Winds indicated by black arrows based on pilot balloon observations at 2100 G. C. T.; those indicated by red arrows based on rawins taken at 0300 G. C. T.

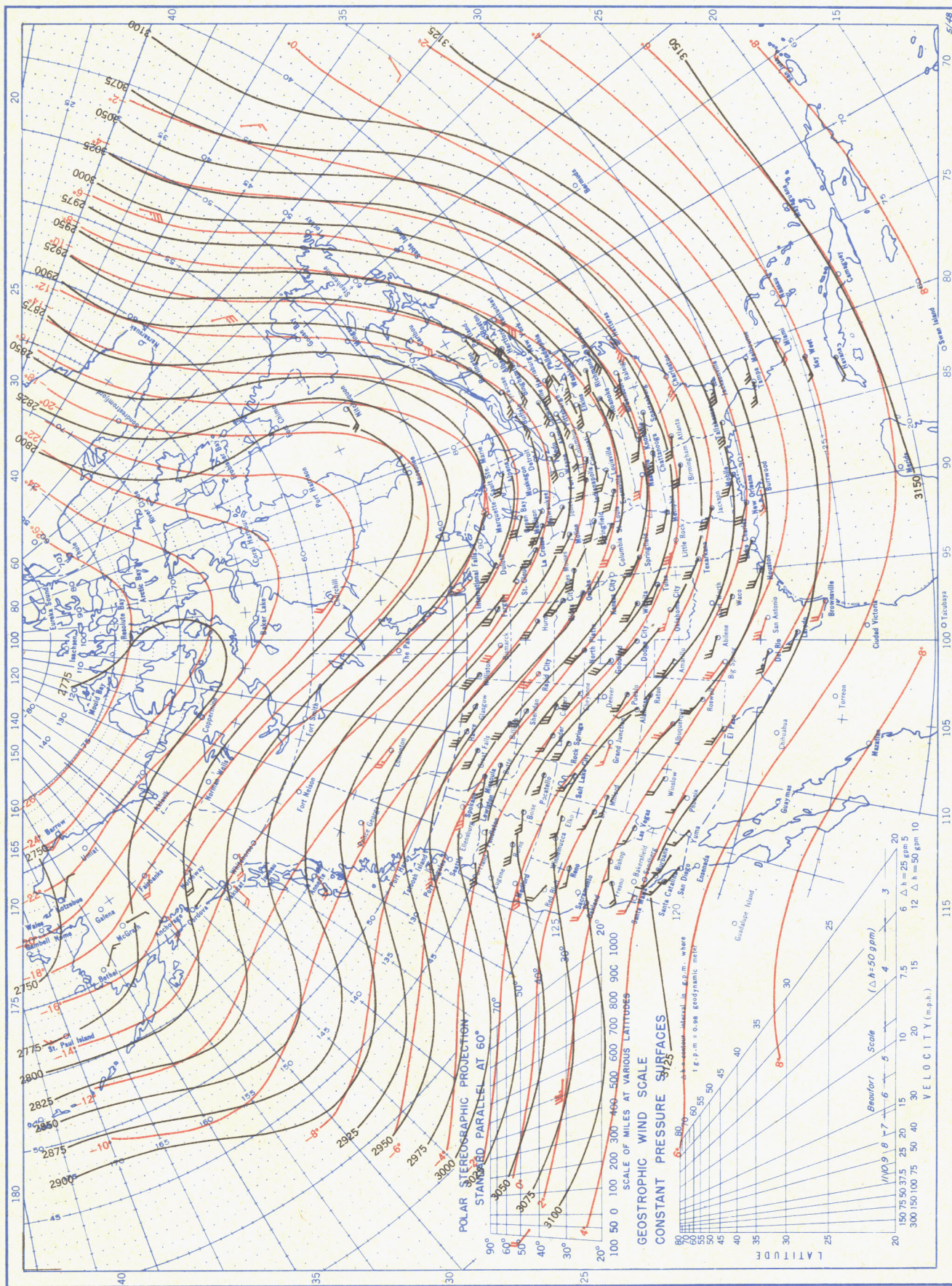


Chart X, December 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 500-millibar Pressure Surface, and Resultant Winds at 5,000 Meters (m. s.l.)

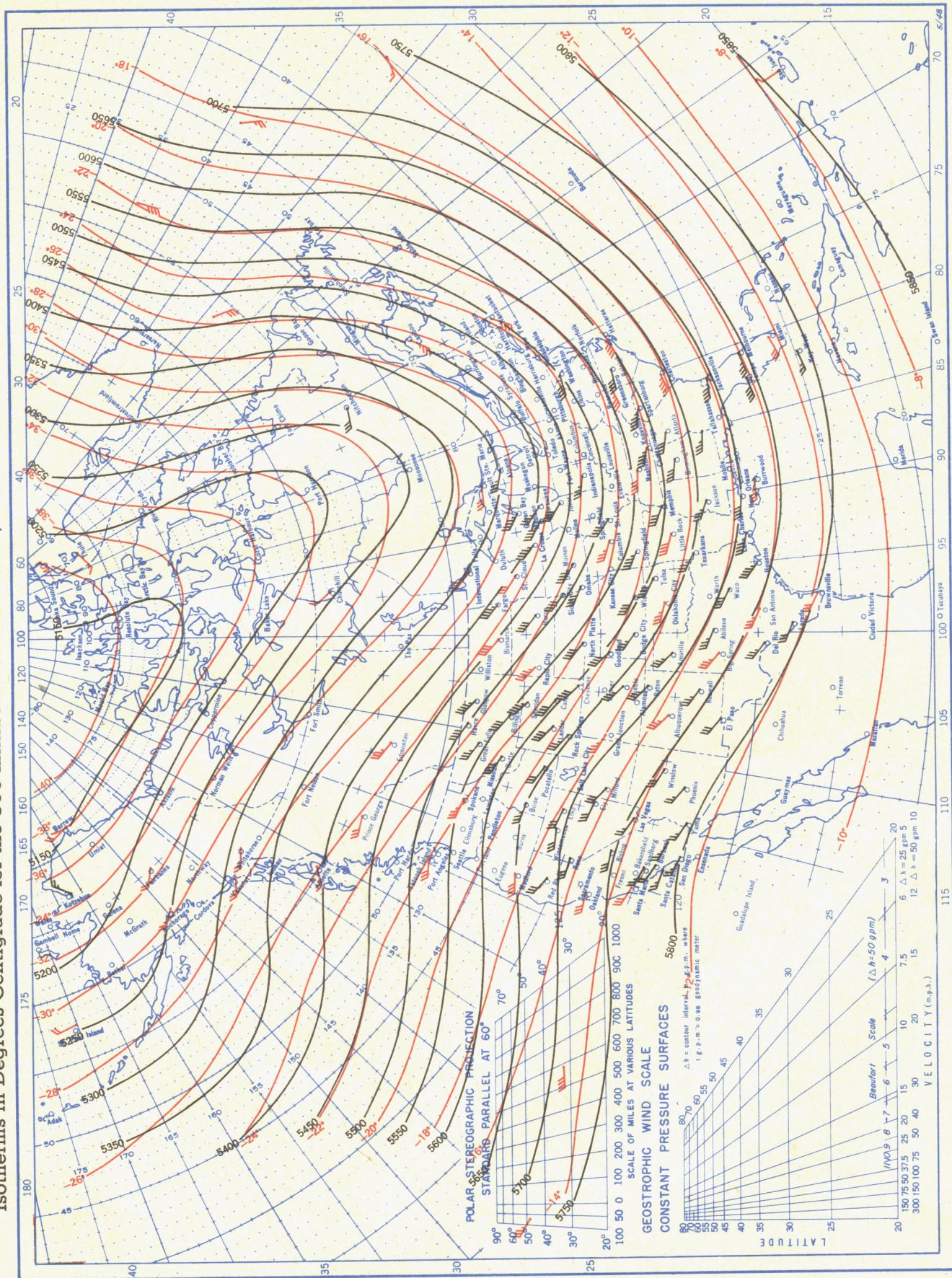


Chart XI, December 1950. Contour Lines of Mean Dynamic Height (Geopotential) in Units of 0.98 Dynamic Meters and Mean Isotherms in Degrees Centigrade for the 300-millibar Pressure Surface, and Resultant Winds at 10,000 Meters (m. s.l.)

